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BACTERIOLOGIC STUDIES OF THE UPPER RESPIRATORY PASSAGES

II. THE PNEUMOCOCCI AND NONHEMOLYTIC STREPTOCOCCI OF THE ADENOIDS AND TONSILS

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In the study of the incidence of the pneumococcus in the mouths of healthy persons it has been found that this organism is common in the saliva and throat. Park and Williams[1] identified typical pneumococci in about 50%; Longcope and Fox[2] and Buerger[3] gave similar percentages. Dochez and Avery[4] found pneumococci in 58.4% and Stillman[5] in about 45%, the great majority of which were types 4 and 3. The investigations were made on the saliva and less often on swabs of the throat and pharynx of normal people. In a study of the hemolytic streptococci of the adenoids and tonsils it was noted that streptococci were present in larger numbers in the crypts and folds than in the swab cultures of the same structures before their removal. To determine more accurately the true incidence of the pneumococci in the oro- and naso-pharynx cultures were made of the extirpated adenoids and tonsils.

The same material from which the hemolytic streptococci were isolated was cultivated on blood-agar plates, both streaked and poured, and studied for the pneumococci and nonhemolytic streptococci. Nasopharyneal swabs, the excised adenoids and tonsils from 21 persons were first cultivated; the extirpated adenoids of 82 persons were also investigated as regards their flora, on the surface as well as the depths, between the vegetations. The patients were children from 5 to 16 years of age, who presented tonsils and adenoids of varying degrees of hypertrophy with no other marked gross changes.

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[1] Jour. Exper. Med., 1905, 7, p. 403.

[2] Ibid., p. 430.

[3] Ibid., p. 497.

[4] Ibid., 1915, 22, p. 105.

[5] Ibid., 1916, 24, p. 651.

This material approaches the normal as nearly as possible. The specimens were obtained during the months of April, May and June, 1920.

Green-producing cocci of three types were encountered; small round, gray, discrete, biconvex, glistening colonies surrounded by a grayish-green zone corresponding to the viridans type of streptococcus; flatter, often checker-like or umbilicated colonies revealing usually lancet-shaped diplococci surrounded by a similar zone of methemoglobin, corresponding to the pneumococcus group; lastly, somewhat larger green moist colonies, often mucoid, showing a marked tendency to become confluent, some corresponding in their appearance to the pneumococcus mucosus, others to the so-called "Mathers" type of streptococcus. Confirmatory studies by means of bile solubility and inulin fermentation were carried out on the isolated pure cultures. Most of the flat checker-like colonies proved to be bile-soluble and to ferment inulin, while the convex type were bile-insoluble and noninulin fermenting; but some exceptions were noted in both. The bile soluble, inulin fermenting strains were classified as pneumococci, and the insoluble, nonfermenting strains as Streptococci viridans.

THE INCIDENCE OF STREPTOCOCCUS VIRIDANS AND PNEUMOCOCCUS IN CULTURES OF NASOPHARYNGEAL SWABS, ADENOIDS AND TONSILS

	Number of Persons	Percentage Positive	
		Pneumococcus	Streptococcus viridans
Series 1. Swabs	21	71.4	90.5
Adenoids	21	71.4	90.5
Tonsils	21	66.6	81.0
Series 2. Adenoids	82	62.3	88.0
Total number adenoids examined	103	65.0	89.0

In the first series of 21, pneumococci occurred in 16 of the swab cultures, in 16 of the adenoids cultures and in 14 of the cultures of the tonsillar crypts. Streptococcus viridans was found in 19 of both swab and adenoid cultures, and in 17 of the tonsil cultures. The Mathers type of streptococcus was encountered once in all. The results are indicated in the table. In the second series of 82 adenoids pneumococci were encountered in 51, streptococcus viridans in 72. It is interesting to observe that in the nasopharyngeal swabs the pneumococci seldom were predominant, whereas in the adenoids from the same persons they were quite numerous in 4 instances and in almost pure culture in 2. Occasionally they were also numerous in the tonsillar crypts.

The crypt-like depressions of the adenoids seemed to harbor larger numbers. In two instances in which the pneumococcus and streptococcus viridans were absent in the tonsils although present in the adenoids, hemolytic streptococci were recovered in pure culture from the crypts. No great variations were noted in the numbers of streptococcus viridans excepting that in the crypts of the tonsils they were often fewer than in the nasopharynx.

In 12 instances typical streptococcus colonies revealing gram-positive cocci in chains were encountered, causing neither hemolysis nor methemoglobin formation.

Forty strains of Streptococcus viridans were inoculated in litmus milk and carbohydrate broth. All acidified and coagulated milk in from 7 to 10 days. The sugar medium contained 1% carbohydrate in infusion broth with Andrade's indicator. Lactose was fermented by all, mannite by 3, salicin by 14. According to Holman's classification, 6% are Strep. fecalis, 30% Strep. motis and 64% Strep. salavarius.

The moist green-forming colonies were somewhat variable in their appearance. Altogether they were encountered in the adenoids of 26 persons. Nine were distinctly moist mucoid colonies like the Pneumococcus mucosus. The other 17, though quite moist, showed a tendency toward flattening and conformed to the description of the so-called Mathers streptococcus. Of the former 9 strains, 6 were bile soluble, 3 insoluble. The 6 strains conform to the true Pneumococcus mucosus; the other 3 might possibly be termed Streptococcus mucosus. Of the 17 Mathers type, 9 were bile soluble, 8 insoluble, 6 fermented inulin and 11 did not. Morphologically, most of these organisms revealed gram-positive capsulated diplococci often lanceolate shaped; the Mathers coccus frequently appeared in chains of variable length.

Agglutination with specific types 1, 2, and 3 serums from the Rockefeller Institute and the New York State Board of Health was carried out on the bile-soluble organisms. Of the total 67 strains, none was agglutinated by type 1, 2 by type 2 and 10 by type 3. Two strains clumped by type 3 serum were not typical mucoid like the Pneumococcus mucosus. Two others were of the Mathers type.

Of the 14 strains from the tonsil, 2 were type 3, 12 were type 4.

SUMMARY

To ascertain more accurately the incidence of pneumococci in the throat and nasopharynx cultures were made from the extirpated adenoids and tonsils.

In a series of 103 adenoids, pneumococcus occurred in 65%, 2% of which were type 2, 13% type 3 and 85% type 4. In the nasopharyngeal swabs of 21 persons the pneumococcus was recovered in 71.4%; from the tonsils of the same persons in 66.6%, and the adenoids in 71.4%. It was observed that in the depths of the folds and the crypt-like depressions of the nasopharyngeal vegetations and from the tonsillar crypts the pneumococci were decidedly more numerous than in the swabs. In 4 instances the pneumococci occurred practically in pure culture from the adenoids.

Streptococcus viridans was found in 89% of the adenoids and 81% of the tonsils. Streptococcus mucosus was encountered in 3% of the adenoids, and indifferent streptococci in 12%. The Mathers coccus was noted in 17% of the adenoids, once in pure culture.

The adenoids and tonsils are foci in which pneumococci and nonhemolytic streptococci commonly flourish.